(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 854 285 A2

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
22.07.1998 Bulletin 1998/30

(51) Int Cl.6: **F04B 7/00**, F04B 15/02

(21) Application number: **98830016.6**

(22) Date of filing: **16.01.1998**

(84) Designated Contracting States:
AT BE CH DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **17.01.1997 IT PR970002**

(71) Applicant: **Ravellini, Gian Guido**
29100 Piacenza (IT)

(72) Inventor: **Ravellini, Gian Guido**
29100 Piacenza (IT)

(74) Representative: **Gotra, Stefano**
Bugnion S.p.A.
Via Garibaldi 22
43100 Parma (IT)

(54) **Pumping device, in particular for cement material**

(57) In a pumping device (1) a first piston pump (4) and a second piston pump (8), having respectively a first suction/delivery mouth (6) and a second suction/delivery mouth (10) both communicating with the inside of a container (2) suitable for containing a material to be pumped, act in phase with one another so that, when one performs the compression phase, the other one performs the suction phase. A connection duct (13) provided with an inlet aperture (14) for the material pressed by the said piston pumps (4) and (8) is able to rotate about an axis of rotation (x-x) with the possibility of assuming selectively at least a first position and a second position in which the inlet aperture (14) is sealingly connected to the first suction/delivery mouth (6) and, respectively, to the second suction/delivery mouth (10). The pumping device (1) is used in particular on building sites for the purpose of conveying concrete.

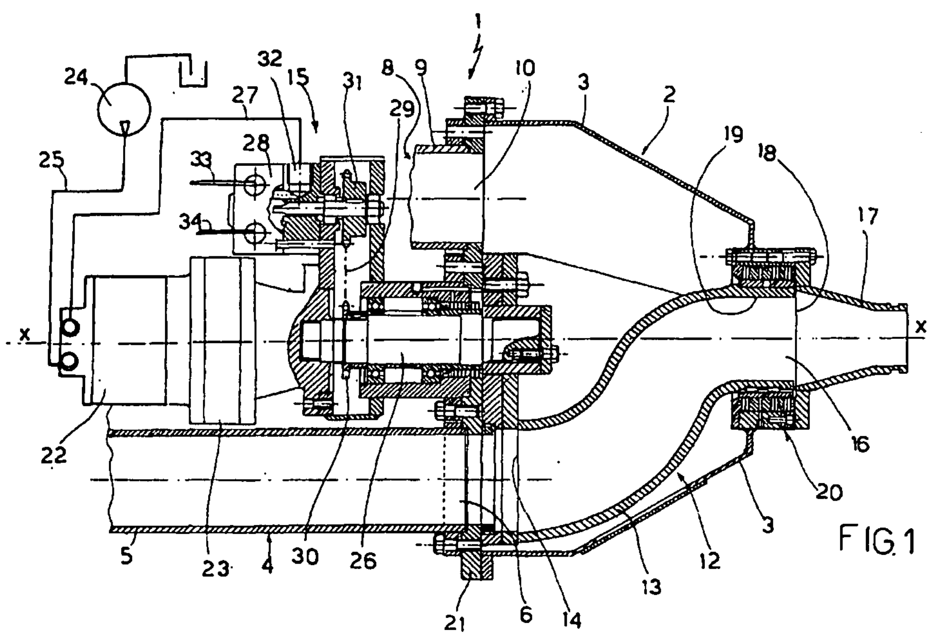


FIG. 1

EP 0 854 285 A2

Printed by Jouve, 75001 PARIS (FR)

Description

The present invention relates to a pumping device, in particular for cement material.

Specifically, but not exclusively, it finds practical application in building sites, for the purpose of conveying concrete.

The invention relates in particular to a device comprising: a container, suitable for containing a material to be pumped: a first piston pump, having a first suction/delivery mouth communicating with the inside of the container; a second piston pump, having a second suction/delivery mouth also communicating with the inside of the container; a deviating member, comprising a movable connection duct provided with an aperture for introduction of the material pressed by the said piston pumps. The said piston pumps, during use, are designed to perform alternately, via the associated suction/delivery mouths, suction and compression of a part of the material contained in the container. The connection duct is capable of rotating, following operation synchronised with that of said piston pumps, about an axis of rotation with the possibility of assuming selectively at least a first position and a second position in which the inlet aperture is sealingly connected to the first suction/delivery mouth and, respectively, to the second suction/delivery mouth. It is envisaged that, in both the abovementioned positions of the connection duct, an outlet end thereof is connected to a duct for conveying the material.

A device of this type for conveying concrete is already known, in which the movable deviating member consists of a curved, elbow-shaped, duct able to perform an oscillating movement about an axis of rotation substantially coinciding with the axis of the entry mouth of the fixed duct for conveying the concrete. In this known pumping device the deviating member is commonly referred to as being of the "elephant trunk" type.

In another known device of the type in question, the deviating member is provided with a movable duct which is also able to perform an oscillating movement, the longitudinal axis of which has a substantially S-shaped configuration.

During an operating phase of these known devices, the deviating member positions the inlet aperture so that it is directly facing, in a sealing manner, the mouth of the pump which is performing the concrete compression or delivery phase, while the mouth of the other pump, during suction, is able to suck in the concrete contained in the container; once the pumps have terminated the corresponding compression and suction phases, the deviating member is displaced so that its inlet aperture sealingly faces the mouth of the pump which previously sucked in the concrete and which is now ready for compression thereof; after which the pumps are activated, with reverse functions compared to the previous phase, namely the pump which previously performed a sucking action now performs a pressing action, and vice versa.

A drawback of the abovementioned known devices consists in the fact that, during displacement of the deviating member from one pump to another, no pumping action is performed. In other words, the time it takes for displacement of the deviating member from one pump to another represents dead time in terms of operation of the device.

Another drawback of the known devices consists in the fact that the pumping cycles and the associated displacements are controlled by solenoid valves and end-of-travel devices which, operating under adverse conditions, are often subject to malfunctions.

The object of the present invention is to overcome the abovementioned drawback of the known art, by providing a pumping device in which there is no dead time.

A further object is that of eliminating all the solenoid valves and end-of-travel devices which are the cause of various drawbacks.

One advantage of the invention is that it is simple and low-cost from a constructional point of view.

Another advantage is that it allows a continuous and regular movement of the deviating member.

These objects and advantages, along with others, are all achieved by the invention in question, as characterized by the claims indicated below.

The invention is described below in detail with reference to the accompanying figures which show a preferred embodiment thereof.

Figure 1 shows a schematic plan view, from above, of the device, interrupted and partially sectioned;
Figure 2 shows a part not shown in the view of Figure 1;
Figure 3 shows a schematic front view of a detail of Figure 1;
Figure 4 shows a schematic section along the plane indicated by IV-IV in Figure 3;
Figure 5 shows a schematic cross-section along the surface indicated by V-V in Figures 3 and 4.

With reference to the abovementioned figures, 1 denotes in its entirety a pumping device comprising a container 2 suitable for containing a material to be pumped. In the case described here, the device 1 is particularly suitable for the pumping of concrete. The container 2, which is of the known type, has walls 3 and has at the top a wide opening for introduction of the concrete. In Figure 1 the container 2 is sectioned along a horizontally sectioned plane.

The device 1 comprises a first piston pump 4 with a horizontal-axis cylinder 5 terminating at one end in a first suction/delivery mouth 6 communicating with the inside of the container 2. 7 denotes the actuating stem of the piston sliding inside the cylinder 5.

The device 1 also comprises a second piston pump 8 with a cylinder 9, the axis of which is parallel to that of the cylinder 5 and lying on the same horizontal plane. The cylinder 9 terminates in a second suction/delivery

mouth 10 communicating with the inside of the container 2 and located alongside the first mouth 6, substantially coplanar with respect to the latter. 11 denotes the actuating stem of the piston sliding inside the cylinder 9.

The two actuating stems 7 and 11 slide inside respective hydraulic cylinders 7a and 11a operated by the hydraulic circuit which will be described below. The piston pumps 4 and 8, during use, are designed to perform alternately, via the associated suction/delivery mouths 6 and 10, suction and compression of a part of the material contained in the container 2. The pumps 4 and 8 are operated by means of a hydraulic transmission circuit, as a result of which the pumps act in phase with one another so that, when one performs the compression phase, the other one performs the suction phase.

The device 1 is provided with a deviating member 12 comprising a movable connection duct 13 provided with an inlet aperture 14 for the concrete pressed by the piston pumps 4 and 8.

The connection duct 13 is capable of rotating about an axis of rotation x-x, following operation by drive means, denoted in their entirety by 15, which act in synchronism with the action of the piston pumps 4 and 8. The connection duct 13 has the possibility of assuming selectively at least a first position and a second position in which the inlet aperture 14 is sealingly connected to the first suction/delivery mouth 6 and, respectively, to the second suction/delivery mouth 10.

The connection duct 13 has an outlet end 16 connected to a conveying duct 17 (illustrated only partly in Figure 1) for conveying the concrete, also at considerable distances and heights. The outlet end 16 and an entry mouth 18 of the conveying duct 17 are coaxial and directly facing one another; their common axis coincides with the axis of rotation x-x of the conveying duct 13, so that during rotation of the latter they remain coaxially facing and communicating. The end part 19 of the connection duct 13 is cylindrical with an axis x-x and is rotatably coupled to the container 2 by means of rolling support elements 20.

The inlet aperture 14 of the duct 13 extends longitudinally between the first suction/delivery mouth 6 and the second suction/delivery mouth 10 and has the shape of a curved eyelet with its longitudinal axis substantially in the form of an arc of a circumference, the centre of which is situated in the vicinity of or coinciding with the axis of rotation x-x of the connection duct 13.

The angular amplitude of the inlet aperture 14 is slightly less than 180°. There are also provided sealing means, of the known type, operating between the inlet aperture 14 and a fixed wear plate 21 which is mounted at one end of the piston pumps 4 and 8 and on which the connection duct 13 is designed to slide during use.

The suction/delivery mouths 6 and 10 of the piston pumps 4 and 8 are situated in diametrically opposite positions with respect to the axis of rotation x-x of the connection duct 13.

The drive means 15 are designed to cause continuous rotation of the connection duct 13. These drive means 15 are arranged outside the container 2 and do not come into contact with the concrete.

The flow cross-section of the connection duct 13 gradually narrows from the inlet aperture 14 towards the outlet end 16 leading into the conveying duct 17. The longitudinal axis of the connection duct 13 is a curved line substantially in the form of an "S", as shown in Figure 4.

The drive means 15 comprise a hydraulic motor 22, with a reducer 23, having a predetermined swept volume equal to the displacement of the two pistons 7a and 11a.

24 denotes a hydraulic pump which transmits the oil to the hydraulic motor 22 by means of the duct 25.

The motor 22 imparts the rotation to a pivot 26 on which the movable connection duct is keyed. The oil leaving the hydraulic motor 22, via a duct 27, enters into a rotating distributor 28 moved, by means of a chain 29, by the same pivot 26 on which a pinion 30 is keyed.

The chain 29, actuated by the pinion 30, causes rotation of a pinion 31 keyed onto a shaft of the rotating distributor 28.

The oil supplied from the motor enters into the rotating distributor through an inlet 32 and emerges alternately from the mouth 33 or 34, each of which supplies respectively the hydraulic cylinder 7a or 11a. The oil which, for example, enters into the chamber of the cylinder 7a compresses the oil which is located underneath the piston and is conveyed, via the connection 35, to the bottom chamber of the other cylinder lla which is thus moved in the opposite direction to the previous one, resulting in the alternating movement of the pistons.

The pumping control system is therefore entirely hydraulic/mechanical.

The device 1 operates as follows.

The piston pumps 4 and 8 are activated so as to perform alternately the respective compression and suction strokes in phase with one another, while the connection duct 13 is operated so as to perform a continuous rotational movement about the axis x-x; this movement is synchronised with operation of the piston pumps 4 and 8. During rotation of the connection duct 13, the inlet aperture 14 is positioned at least partially facing, in a sealing manner, the end mouth of one of the piston pumps, i.e. the pump performing the compression phase. In this way the concrete is able to pass, via the connection duct 13, from the pump to the conveying duct 17. When the compression phase of a pump (for example the first pump 4) has ended, one end of the aperture 14 in the form of a curved eyelet is still in communication with the end mouth 6 of this pump, while the opposite end of the aperture 14 is about to position itself facing the mouth of the other pump 8 which, in the meantime, has concluded its suction phase. Continuing the rotation of the connection duct 13, the aperture 14 will come to face, with its front end (relative to the direction of rotation), the pump 8 ready for the compression phase,

while the mouth 6 of the other pump 4 will no longer be communicating with the aperture 14 and this pump 4 will therefore be able to proceed with the concrete suction phase being directly in communication with the inside of the container 2. In this way there is no dead time during operation of the device 1, since as soon as one pump has terminated its compression phase, the other pump may almost immediately start its compression phase.

Claims

1. Pumping device (1) of the type comprising: a container (2), suitable for containing a material to be pumped; a first piston pump (4), having a suction/delivery mouth (6) communicating with the inside of the container (2); and a second piston pump (8), having a second suction/delivery mouth (10) also communicating with the inside of the container (2), the said piston pumps (4) and (8), during use, being designed to perform alternately, via the associated suction/delivery mouths (6) and (10), suction and compression of a part of the material contained in the container (2), characterized in that it comprises a deviating member (12), comprising a movable connection duct (13) provided with an aperture (14) for introduction of the material pressed by the said piston pumps (4) and (8), the connection duct (13) being capable of rotating continuously, following operation synchronised with that of said piston pumps (4) and (8), about an axis of rotation (x-x) with the possibility of assuming selectively at least a first position and a second position in which the inlet aperture (14) is sealingly connected to the first suction/delivery mouth (6) and, respectively, to the second suction/delivery mouth (10), it being envisaged that, in both the abovementioned positions of the connection duct (13), an outlet end (16) thereof is connected to a duct (17) for conveying the material, said inlet aperture (14) extending longitudinally between the first and the second suction/delivery mouths (6) and (10) and having its longitudinal axis substantially in the form of an arc of a circumference, the centre of which is situated in the vicinity of or coinciding with the axis of rotation (x-x) of the connection duct (13).

2. Device according to Claim 1, characterized in that it comprises means (15) designed to cause continuous rotation of the connection duct (13).

3. Device according to Claim 1 or 2, characterized in that the suction/delivery mouths (6) and (10) of the piston pumps (4) and (8) are situated in diametrically opposite positions with respect to the axis of rotation (x-x) of the connection duct (13).

4. Device according to any one of the preceding claims, characterized in that the flow cross-section of the connection duct (13) narrows gradually from the inlet aperture (14) towards the said outlet end (16).

5. Device according to any one of the preceding claims, characterized in that the said drive means (15) designed to cause rotation of the connection duct (13) are located outside the container (2).

6. Device according to any one of the preceding claims, characterized in that the said drive means (15) comprise a hydraulic motor (22) which imparts the rotation to the connection duct (13) and to a rotating distributor (28) which is supplied with the discharge oil of the motor and transmits said oil alternately to the inlet of one of two hydraulic cylinders (7a) or (11a) which actuate respectively the piston pumps (4) and (11).

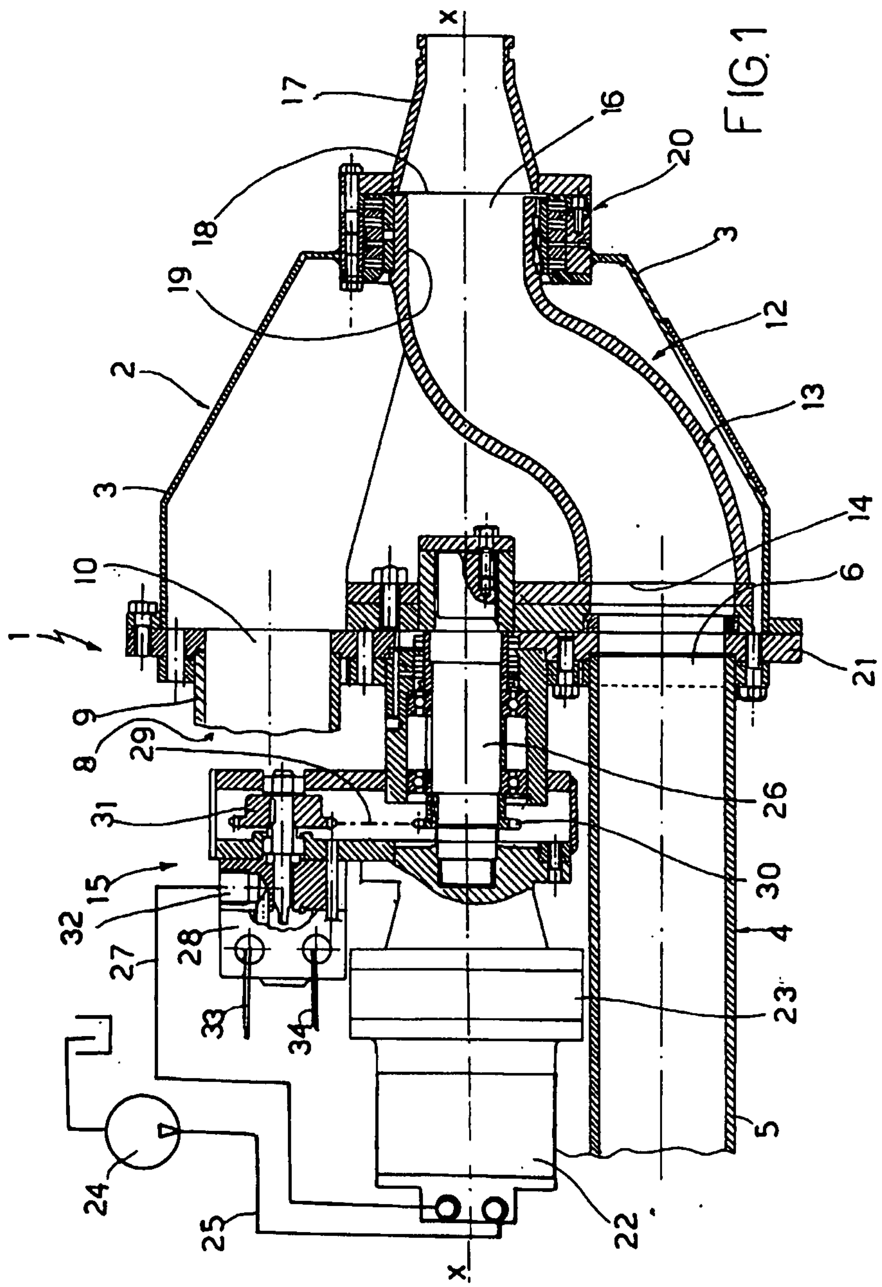

x
17
16
20
18
3
19
12
2
13
3
14
10
6
1
21
9
8
29
26
31
30
15
32
4
27
28
23
33
34
5
24
22
25
x

FIG.1

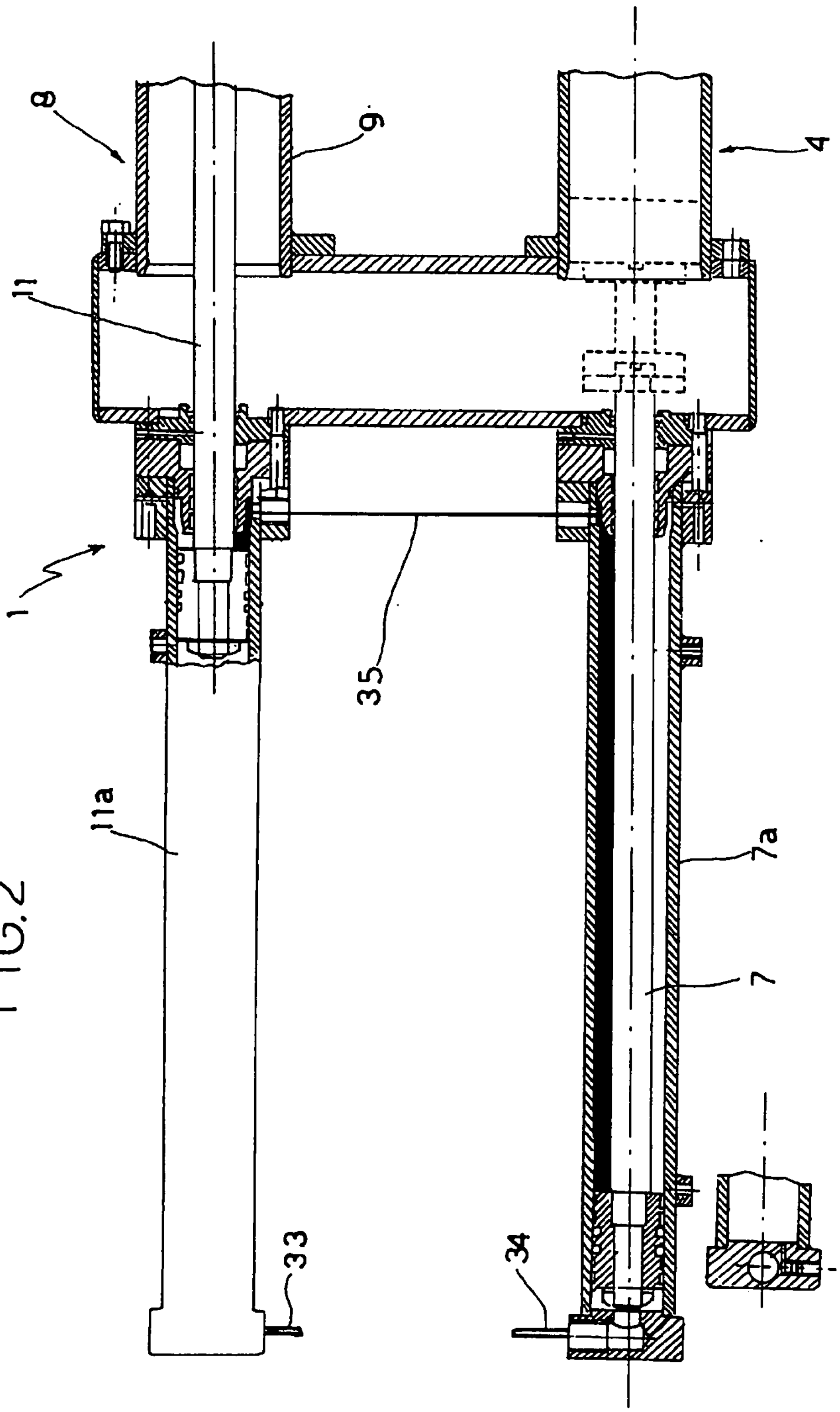


FIG.2

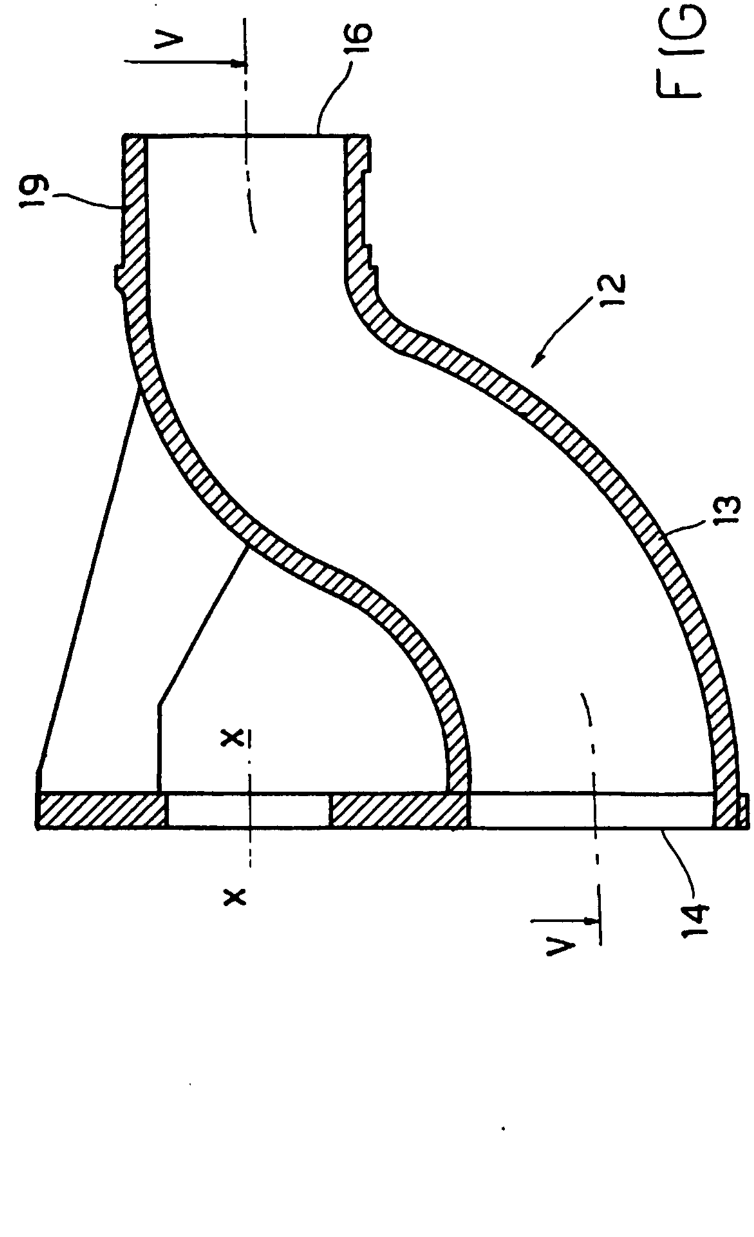
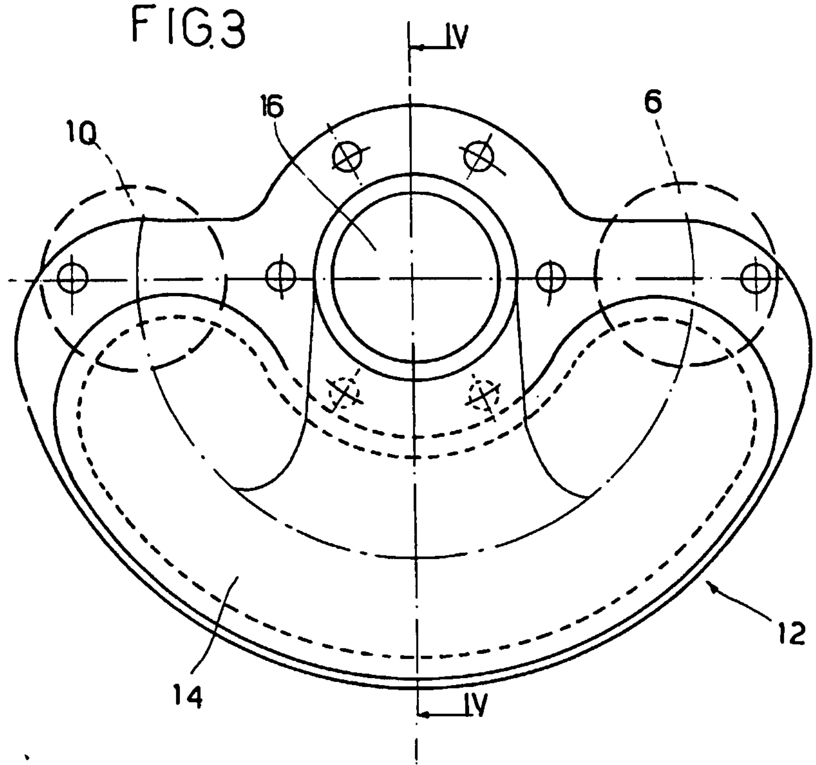


FIG. 4

FIG.3



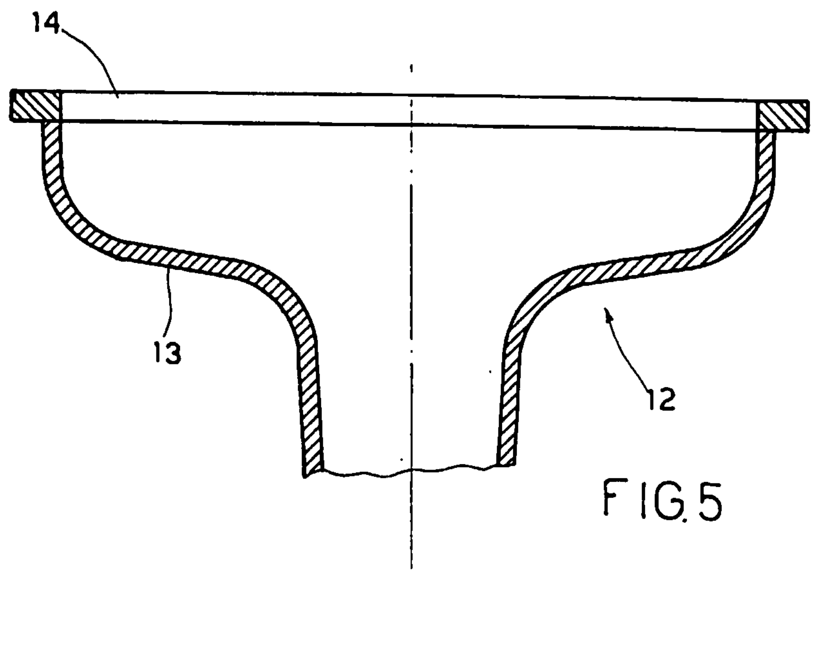


FIG.5